CASE-BY-CASE ANTIDEGRADATION ANALYSIS

Prepared for

BP
Whiting Indiana

Prepared by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

1.0 INTRODUCTION AND SUMMARY

1.1 INTRODUCTION

BP is providing this Case-by-Case Antidegradation Analysis to meet the requirements of Section 5-2-11.7(a)(1)(B)(iv) of Title 327 of the Indiana Administrative Code (IAC). This Case-by-Case Antidegradation Analysis is being performed in support of BP's Updated NPDES Permit Renewal Application. The Updated NPDES Permit Renewal Application, originally submitted in August 1994 and updated in March 1998 and April 2002, has been recently revised (via addendum submittals dated October 13, 2006 and November 3, 2006) to reflect BP's intention of reconfiguring the Whiting Business Unit to process Canadian extra heavy crude oils (CXHO). The planned facility reconfiguration will result in increased coker production, increased hydrotreating, and increased alkylation which, according to United States Environmental Protection Agency (EPA) effluent limitation guidelines (ELGs) for "best" refinery control technology, would result in increased effluent mass discharge of BOD, TSS, COD, Oil & Grease, Phenolics, Ammonia-N, Sulfide, Total Chromium, and Hexavalent Chromium. According to 327 IAC 5-2-11.3(b), an antidegradation review is required when a planned facility activity could cause an increase in effluent mass (load). In accordance with 327 IAC 5-2-11.7(a)(1)(B)(iv), if the increase in mass discharged is not related to an increase in discharge flow, a requested increase in a mass effluent limitation is evaluated on a case-by-case basis.

1.2 SUMMARY

BP has prepared this Antidegradation Analysis to evaluate the impact of BP Whiting's effluent as a result of the CXHO project in accordance with Indiana's environmental regulations to support a case-by-case determination under the antidegradation regulations.

The analysis concludes:

1) BP is undertaking significant activities to minimize any increases in the discharge of pollutants. As a result of the CXHO project, BP Whiting's discharge to Lake Michigan will remain protective of the lake's designation as a public water supply.

2) There will be a very positive socio-economic benefit nationwide and to the Northwest Indiana area from the project's implementation.

Based on this analysis, it is recommended that IDEM determine that the antidegradation standard is satisfied through implementation of limits for TSS and Ammonia-N based on the currently applicable federal effluent limitation guidelines (ELGs) (327 IAC 5-2-11.7(a)(1)(B)(iv)).

In order to illustrate that the antidegradation standard is satisfied, this Antidegradation Analysis includes the following information:

- Analysis of the Antidegradation Regulation (Section 3.0)
- Discussion of Current and Proposed ELG Technology-Based Limits (Section 4.0)
- Evaluation of Need for Proposed ELG Technology-Based Limits (Section 5.0):
  - Alternatives Analysis
  - Socio-Economic Impact Evaluation

2.0 BACKGROUND

BP is reconfiguring the BP Whiting Business Unit (BP Whiting) to process Canadian extra heavy crude oils (CXHO) derived from bitumen rather than the current crude slate of non-bitumen derived crudes. Bitumen is a category of organic liquids that are highly viscous, black, tar-like substances. In order to process such substances at the existing crude process rate of 420,000 barrels per day (bbl/d), BP Whiting must expand its coking, hydrotreating, and akylation capacity. In addition, associated processes related to sour water management, sulfur recovery, power, and steam will be expanded.

Bitumen derived feedstocks are generally heavier and can contain higher concentrations of metals (e.g., selenium and vanadium) and other constituents (e.g., nitrogen and sulfur) than non-bitumen derived crudes. As a result, the processing of CXHO may be less amenable to oil and solids separation and may result in higher levels of ammonia, hydrogen sulfide, and metals as compared with processing of non-bitumen derived feedstocks and as such, may in turn impact desalting, sour water stripping, coking, sulfur recovery, and wastewater treatment capacities. Therefore, as part of the CXHO Reconfiguration Project, BP will provide for desalter brine treatment at the Pipestills, increased sour water stripping capacity at the Sulfur Recovery Complex, and the following at the Whiting's Lakefront Wastewater Treatment Plant (WWTP): installation of an additional equalization/storm surge tank, upgrades to the existing API separators, and upgrades to the existing final filters.

BP has recently submitted to the Indiana Department of Environmental Management (IDEM) pertinent revised pages to BP Whiting's April 2002 NPDES Permit Renewal Application (Updated Volume 1) that incorporate the addition of the CXHO refinery configuration.

The pertinent revised pages also include updated post-CXHO technology-based effluent limitations (TBELs). TBELs are industry-specific production-based limits based on the best available technology economically achievable (BAT) for treatment of wastewaters generated from a specific industrial category. For BP Whiting, TBELs for the petroleum refining point source category would apply. Detailed discussions of TBEL development specific to BP Whiting is presented in Section 4.0.

3.0 ANALYSIS OF ANTIDEGRADATION REGULATION

According to 327 IAC 5-2-11.3(b), an antidegradation review is required when a planned facility activity could cause an increase in effluent mass (load). If the proposed increase in mass is not related to an increase in discharge flow, the requested increase in a mass effluent limitation is evaluated on a case-by-case basis (327 IAC 5-2-11.7(a)(1)(B)(iv)). Because the CXHO project will not increase the amount of effluent flow discharged, IDEM is allowed to evaluate antidegradation requirements and establish an appropriate limit on a case-by-case basis.

Water management issues have been given careful consideration in preparing the scope of work for the CXHO project and how they will be integrated into the new processes in the overall operation of the BP Whiting refinery. The reconfiguration of the refinery has been engineered to assure that the discharge flow will not increase, even though the mass limits for some constituents may increase, after the CXHO project is implemented. Because there will be no increase in the refinery's effluent flow, a case-by-case antidegradation analysis has been prepared for IDEM's review, as allowed by regulation.

4.0 DISCUSSION OF CURRENT AND PROPOSED ELG TECHNOLOGY-BASED LIMITS

4.1 TECHNOLOGY-BASED EFFLUENT LIMITS

BP Whiting is subject to TBELs pursuant to the petroleum refining point source category regulations (40 CFR 419). Pursuant to 40 CFR 419, TBELs for the petroleum refining point source category are determined based on refinery categorization, process factors, size factors, and crude through-put.

Process factors are determined from assigned weighting factors unique to each of the following four process categories: (1) Crude, (2) Cracking and Coking, (3) Lubes, and (4) Asphalts. Size factors are determined from the through-put of each stream in the following five subcategories: (1) Topping, (2) Cracking, (3) Petrochemical, (4) Lubes, and (5) Integrated. The size factor is then multiplied by the process factor and crude through-put to determine the daily maximum and monthly average TBELs for each subcategory, when applicable.

The maximum and monthly average TBELs that BP Whiting is subject to consist of 5-day biochemical oxygen demand (BOD), total suspended solids (TSS), chemical oxygen demand (COD), oil and grease (O&G), phenolic compounds (Phenols), Ammonia-N, sulfide, total chromium, hexavalent chromium, and pH.

4.2 EXISTING CONFIGURATION TECHNOLOGY-BASED EFFLUENT LIMITS

Table 1 presents the existing configuration of the BP Whiting refinery (as described in the April 2002 updated permit renewal application). From this refinery configuration, the size and process factors are assigned from 40 CFR 419.22 (b) and are used to calculate the TBELs. Table 2 presents the calculation of the BP Whiting limits using BPT, BAT, and BCT methods. Table 3 presents the effluent limit calculations for phenolic compounds, total, and hexavalent chromium. The most stringent of all limitations is compiled to present the controlling effluent limitations that would be used for existing configuration TBELs (Table 2).

Table 4 presents a summary of the TBELs in BP Whiting's NPDES Permit that has been administratively extended since 1995. The TBELs in the NPDES Permit are different from those developed based on the existing configuration (Table 2) primarily because the permit TBELs were calculated based on a refinery configuration that included waxes and lubes production, the result of which triggered the Waxes and Lubes subcategory discussed in the previous section. The discontinuation of Waxes and Lubes production at the end of 1998 resulted in reduced air emissions from fugitive sources and heaters of Methyl Ethyl Ketone (MEK) from dewaxing units/operations, and also resulted in reduced discharge of oil and solvents to the process wastewater system (see above about reductions in TSS). The difference in TBELS between the existing configuration and the NPDES permit is also due to the changes in refinery throughput as well as retention of ELGs from previous NPDES permits. A history of ELG implementation for the BP Whiting refinery is presented in Attachment 1. This history chronologically presents the application of NPDES ELGs since 1974 and includes calculated ELGs submitted to IDEM since 1994 during the ongoing permit renewal process. Based on the history, effluent limitations for BOD, TSS, COD, O&G, Phenols, Ammonia-N, sulfide, total chromium, and hexavalent chromium in the current permit all appear to have been originally derived from technology-based effluent limit guidelines.

4.3 CXHO PROCESS CONFIGURATION TECHNOLOGY-BASED EFFLUENT LIMITS DETERMINATION

Table 5 presents the configuration of the BP Whiting refinery after the introduction of CXHO. Table 6 presents the calculation of the BP Whiting limits using BPT, BAT, and BCT methods for the CXHO configuration. Table 7 presents the effluent limit calculations for phenolic compounds, total, and hexavalent chromium. The most stringent of all limitations is compiled to present the controlling effluent limitations that would be used for the CXHO configuration TBELs (Table 6).

The CXHO configuration TBELs are greater than the existing configuration TBELs due primarily to the expansion of required capacities of coking and hydrotreating in order to process the heavier CXHO crudes and are not due to an increase in the design crude feedstock rate, which will remain the same at about 420,000 bbl/d.

Through implementation of specific water reduction projects, BP Whiting's current Lakefront WWTP Outfall 001 maximum monthly average discharge flow of 21.4 million gallons per day (MGD) will also remain the same after CXHO reconfiguration. Pursuant to 327 IAC 5-2-11.7(a)(1)(B)(iv), a facility could request increases in TBELs for discharges to an outstanding state resource water (i.e., Lake Michigan) that do not result in or are not attributable to an increase in discharge flow. The increase, as defined in the Indiana Administrative Code, should be evaluated on a case-by-case basis.

In order to assist IDEM in determining appropriate antidegradation limits for the reconfigured facility, the following sections discuss the necessity of obtaining increases in two discharge parameters relative to the current permit TBELs, as well as a socio-economic impact analysis of BP Whiting's proposed CXHO reconfiguration.

5.0 NEED FOR PROPOSED CXHO TECHNOLOGY-BASED EFFLUENT LIMITS

This section includes an evaluation of the feasibility of compliance with the CXHO configuration TBELs and presents an alternatives analysis for those parameters for which increases in TBEL limits are proposed.

5.1 CURRENT PERMIT TECHNOLOGY BASED EFFLUENT LIMIT COMPLIANCE EVALUATION

In order to determine the feasibility of compliance with the current permitted effluent limitations, BP developed several models for projecting and predicting effluent quality from the Lakefront WWTP before and after CXHO reconfiguration. These models take into account the effects of CXHO from the standpoints of:

- Refinery process configuration change, and the effects of the technology-based effluent limitations (TBELs),
- Comparison of the current permit TBELs to the CXHO configuration TBELs,
- The effects of CXHO processing at the BP Toledo Business Unit refinery, and
- CXHO characteristics and loading and nutrient changes.

The results of these models are compared with the current NPDES Permit limits to determine feasibility of compliance. Derivation and explanation of these projections are discussed below.

5.1.1 Comparison of CXHO Configuration TBEL and Current Permit Limits

A comparison of the current NPDES Permit effluent limits previously presented in Table 4 and the CXHO configuration TBELs from Table 6 is presented in Table 8. The percent increase in limits is calculated to determine how each of the parameters is affected by the CXHO configuration change.

5.1.2 BP Toledo Sampling Results

In March and May 2006, BP performed sampling at the BP Toledo, OH crude units. At BP Toledo, Crude Unit I runs a CXHO-majority blend, while Crude Unit II is non-CXHO. While the CXHO crude slate at Crude Unit I is not the same blend that is planned for BP Whiting, the difference between Crude I and Crude II at Toledo is a good indicator of CXHO vs. non-CXHO crude processing. Because the wastewater generated from the crude units is commingled at BP Toledo prior to entering the wastewater treatment plant, the desalter brine effluent for each crude unit was sampled and analyzed separately. The results of these sampling events are presented in Table 9. The percent change between Crude Unit I and Crude Unit II (CXHO vs. non-CXHO) is an indicator of the percent change in influent constituents that BP Whiting may experience when starting to process CXHO crudes. Because BOD data were not collected during the Toledo sampling, the Crude I and II Pipestill brine BOD was calculated using a typical refinery COD/BOD ratio of 1.5.

5.1.3 CXHO Crude Characterization and Loading Change

Tables 10, 11, and 12 project the effluent ammonia-nitrogen, BOD, and COD based on the following factors:

- Historical Lakefront WWTP performance,
- Estimated increase in loading from CXHO,
- Typical refinery COD/BOD ratios, and
- Ammonia requirements to support biological processes.

A 1993 BP Whiting Source Survey shows that the Lakefront WWTP was receiving 805 lbs/day and discharging 41 lb/day of ammonia nitrogen, resulting in a 94.9% removal rate. Lakefront WWTP operating data from 2003 – 2005 is presented in Table 10. Based on these data, the WWTP was receiving 1,668 lbs/day of nitrogen and discharging 88 lbs/day of ammonia-nitrogen during this period. The increase in ammonia from the 1993 source survey is most likely due to the increase in crude processing, removal of the wax and lubes units, and sour water management changes that have occurred since 1993.

Because some of the Lakefront WWTP effluent was recycled for use in the cooling towers, the 2003 – 2005 Lakefront WWTP operational data may not be an accurate reflection on actual Lakefront WWTP performance. The time period of 2001 – 2002 was selected for additional analysis because of similar conditions of equipment and influent quality compared to the 2003 – 2005 period, but all of the effluent from the Lakefront WWTP was discharged out of the NPDES-permitted Outfall 001. Tables 11 and 12 present the nutrient and organic loading using the 2001 – 2002 maximum monthly average and long term average, respectively, and applying the anticipated CXHO-effect changes on the plant performance.

EPA has determined, during development of technology-based refinery discharge limits (ELGs), that increased crude processing and coking should increase the COD discharge (expected for the wastewater technology). The TBELs for COD will increase for refinery reconfiguration for CXHO as shown on Table 8. The allowable effluent mass increase in COD, expressed as a percent, is 42%.

Bitumen typically contains 0.36% nitrogen (3,600 ppm), while crudes such as West Texas Intermediate contain 0.08% nitrogen (800 ppm), a 450% increase. The nitrogen loading to Whiting post-CXHO used in the sour water stripper design calculations and in the nitrogen distribution as presented in the June 2006 BP report is 373,672 lbs/d.

Tables 10, 11 and 12 present an evaluation of WWTP nitrogen and organic loading for 2003 – 2005 and 2001 – 2002 (max monthly average), and 2001 – 2002 (long term average), respectively, and the projected impact of nitrogen loading post-CXHO. The discussion of these tables is presented below.

Because nitrogen is used as a nutrient in the biological processes of the WWTP, the amount of nitrogen removed as a function of BOD reduction must be accounted for. The WWTP measures COD, not BOD, on the influent to Lakefront WWTP. In the absence of WWTP influent BOD data, a typical refinery COD:BOD ratio of 1.5 is applied to estimate the WWTP influent BOD loading. As shown in Table 6, between 2003 and 2005 the WWTP received approximately 17,925 lbs/day of BOD, and discharged and average of 255 lb/day of BOD (the effluent value is measured as BOD not converted from a COD

value). This results in 17,669 lbs/day of BOD removed by the WWTP, a 99% removal rate.

Biological wastewater treatment plants require 5 lbs of nitrogen per 100 pounds of BOD removed. By using this ratio, an average of 883 lbs/day of nitrogen was required for BOD removal in 2003 – 2005.

Using the sour water stripper bottoms data collected in March and May of 2006, an average ammonia-nitrogen loading of 248 lbs/d results from the sour water stripper bottoms. From the 2003 – 2005 WWTP monitoring data, 1,668 lbs/day of nitrogen was received at the WWTP. Subtracting the 883 lbs/day required for BOD removal, the WWTP had 784 lbs/day of excess nitrogen. The WWTP discharged an average of 88 lbs/day of ammonia-nitrogen during this period, indicating that 697 lbs/day of nitrogen were nitrified (an 89% removal). This corresponds to an effluent nitrate-nitrogen concentration of 5 mg/L.

Using the 42% increase in allowable COD discharge as an indication of percent increase in biological loading after CXHO, the post-CXHO influent BOD loading is estimated to be 20,255 lbs/day. Using the 99% BOD removal from the 2003 – 2005 data, 19,966 lbs of BOD removed per day is the calculated biological removal rate post-CXHO.

Using the BOD:N ratio of 100:5, 998 lbs/day of nitrogen are required to remove the 19,966 lbs/day of BOD.

By subtracting the 1,668 lbs/d of nitrogen received by the WWTP in 2003 – 2005, and the 248 lbs/d of ammonia-nitrogen generated from the sour water stripper bottoms, a nitrogen loading of 1,420 lbs/d results from other refinery processes. Using the upgraded sour water stripper design information provided by Jacobs Engineering in the BP June 2006 report, an estimated 900 lbs/d of ammonia nitrogen is anticipated from the sour water stripper bottoms. Assuming these other refinery processes will remain unchanged post-CXHO, the 900 lbs/d of ammonia from the post-CXHO sour water stripper bottoms is added to the nitrogen loading from the other sources, resulting in 2,320 lbs/d of nitrogen discharged to the WWTP.

This process is repeated using the Lakefront WWTP 2001 – 2002 maximum monthly average and the 2001 – 2002 long-term average as the input values (Tables 11 and 12, respectively). As discussed above, BP believes that these data are more representative of actual Lakefront WWTP performance without recycle of effluent to the cooling towers. The 2003 – 2005 data were included to provide consistency with the BP June 2006 report.

5.1.4 Post CXHO Effluent Projections

A summary and evaluation of all effluent quality projection models is presented in Table 13. This table contains the following data:

- Current permit effluent limitations,
- Long term average of the 2003 – 2005 Lakefront WWTP performance (influent and effluent),
- Daily maximum values of the 2001 – 2002 Lakefront WWTP performance,
- Maximum monthly average of the 2001 – 2002 Lakefront WWTP performance, and
- Long term average of the 2001 – 2002 Lakefront WWTP performance.

BP believes that the 2001 – 2002 Lakefront WWTP performance data are the most representative of the effluent data presented because the effluent from Lakefront WWTP was not recycled back to the BP Whiting cooling towers as in the 2003 – 2005 data set. By recycling the effluent, the effluent data are not a true representation of Lakefront WWTP performance and removal efficiencies. Similarly, the 2001 – 2002 daily maximum data set is not representative of typical Lakefront WWTP operations, and is only presented to demonstrate the potential range of effluent, but is not used in effluent projection calculations.

Table 13 presents the summation of all effluent projection models. These models use data derived from:

- 2003 – 2005 Lakefront WWTP data (Table 10),
- 2001 – 2002 maximum monthly average Lakefront WWTP data (Table 11),
- 2001 – 2002 long term average Lakefront WWTP data (Table 12),

- March and May 2006 sampling events at the BP Toledo refinery (Table 9), and
- The CXHO refinery configuration change as shown in the TBEL calculations (Table 10).

From these models, the projected Lakefront WWTP effluent quality is calculated using the 2001 – 2002 Lakefront WWTP long term average removal efficiencies (where available).

5.1.5 CXHO Effluent Projections vs. Current NPDES Permit Limits

In order to present a conservative estimate of projected effluent quality on the BP Lakefront WWTP after the introduction of CXHO to BP Whiting, the maximum effluent quality value determined on Table 13 is selected and compared to the current permit effluent limitations (Table 14). From this comparison, BP has determined that there is a potential for the Lakefront WWTP to have difficulty complying with TSS, COD, O&G, Ammonia-N, sulfide, and hexavalent chromium.

As part of the CXHO Reconfiguration Project BP will commit to approximately $90 million (Table 15) in additional capital expenditures to:

- Provide for desalter brine treatment;
- Increase sour water stripping capacity
- Repair and/or upgrade the existing API separators at BP Whiting's Lakefront WWTP;
- Upgrade the existing Lakefront WWTP final filters;
- Construct an additional equalization/storm surge tank upstream of the Lakefront WWTP process; and
- Implement refinery-wide water reduction projects.

As a result of this commitment, BP is comfortable that it can comply with the current NPDES permit limits for COD, O&G, sulfide, and hexavalent chromium. For the remaining two parameters, TSS and Ammonia-N, BP would require the new post-CXHO TBELs. Justification for these increases is provided in the next section.

5.2 ALTERNATIVES ANALYSIS

This section presents an alternatives evaluation that provides more detail with respect to the justification for the proposed increases in TSS and Ammonia-Nitrogen effluent limitations. Although it is not specifically made applicable to case-by-case determinations under 327 IAC 5-2-11.7(a)(1)(B)(iv), an alternatives analysis generally should identify measures available to minimize or prevent the proposed lowering of water quality. Such an analysis might include:

- A Pollution Prevention Alternatives Evaluation;
- Non-Discharge Alternatives Evaluation;
- Discharge Minimization and Pollution Prevention Alternatives Evaluation; and
- Treatment Scenarios Evaluation.

Because BP Whiting is an existing discharger, the Pollution Prevention, Non-Discharge, Discharge Minimization and Pollution Prevention Alternatives Evaluations do not apply. BP therefore focused on an evaluation of treatment scenarios.

The Treatment Scenarios Evaluations for TSS and Ammonia-Nitrogen are presented in the following sections.

5.2.1 Treatment Scenario Evaluation for TSS

As previously discussed in detail, the processing of CXHO crudes would result in more solids being discharged from the Lakefront WWTP. This increase in solids is primarily the result of the increase in Lakefront WWTP influent solids due to increased coking and desalting. The implementation of a brine treatment system at the pipestills will reduce solids loadings to the WWTP and the upgrades of the final filters at the WWTP will increase solids removal capabilities in the effluent post CXHO; however, it will still be very difficult to meet existing TSS limitations. As indicated on Table 13, which summarizes current discharge quality, BP Whiting has issues with TSS compliance even without processing CXHO crudes. One mechanism currently used to reduce TSS discharges is to recycle a portion of the WWTP discharge back to the refinery cooling towers for use as make-up water. However, a direct consequence of utilizing the

discharge for cooling tower make-up water is the cycling up of metals that occurs. This increase in metals concentration is depicted in Figure 1 using selenium as an example. Metals of note that are currently found as sources in the crudes, and are anticipated to increase in CXHO crudes with higher sulfur content, include vanadium and selenium. Recycling effluent to the cooling towers would result in increased concentrations of vanadium and selenium in the cooling tower blowdown, which is discharged to the process sewer and ultimately ends up at the refinery WWTP. Thus, it is not an environmentally friendly option to recycle discharge back to the cooling towers. In addition, it would be very difficult to cost-effectively treat each cooling tower blowdown source for metals due to the various number of cooling towers in the refinery and the fact that they are physically spread out over the refinery site. In addition, the type of treatment necessary would result in increased solid waste disposal.

5.2.2 Treatment Scenario Evaluation for Ammonia-N

As previously mentioned, because CXHO crudes have significantly higher nitrogen content than non-CXHO crudes, additional ammonia-N is assumed to be discharged. The increase in coking will result in higher ammonia-N loading to the Lakefront WWTP because of the increase in sour water generation. As part of the CXHO project, increased sour water stripping capacity, estimated at $37m, will be installed at the Sulfur Recovery Complex. The chosen stripper technology is single-stage. An alternative two-stage stripping technology was also evaluated, but it was found that it did not result in any increased reduction in ammonia loading. Additional ammonia removal can be achieved via increased steam load to the stripper. This would require additional equipment including a steam reboiler and piping. Experience at other BP facilities has found that this type of equipment operating under the process conditions present (H2S levels, temperature, pH, etc.) became unreliable due to corrosion. Therefore, that technology was eliminated from evaluation primarily due to feasibility.

5.3 SOCIO-ECONOMIC ANALYSIS

BP's CHXO project, which is to reconfigure the Whiting Refinery so most of its feedstock can be heavy Canadian crude oil, is a project that is important to the economies of both the United States and Canada. Not only will the project provide a significant market for

Canada's abundant heavy crude oil resources, but it also will increase the diversity and security of oil supplies that can be refined into gasoline, diesel and other petroleum products in demand by consumers in the Midwestern United States. BP's investment (estimated at over $3 billion) in reconfiguring the refinery has the potential to increase its production of motor fuels by about 15 percent, which is about 1.7 million additional gallons of gasoline and diesel per day.

The project also has strong local benefits. Once completed, the project would allow the Whiting Refinery to continue to operate as a viable business and employer of northwest Indiana. It would contribute to the tax bases of the cities of East Chicago, Whiting and Hammond. The project will result in an approximate $1.4 billion investment in East Chicago, approximate $80 million in Whiting and approximately $50 million in Hammond.

The CXHO Project will result in the creation of approximately 70 net new, full-time positions earning an average wage of $26.61 an hour by 2011. It will also create about 2,500 temporary construction jobs for contractors during peak construction. The construction will be completed in a 3 to 4 year period beginning in 2007.

6.0 CONCLUSIONS

This Case-by-Case Antidegradation Analysis concludes:

1) BP is undertaking significant activities to minimize any increases in the discharge of pollutants. As a result of the CXHO project, BP Whiting's discharge to Lake Michigan will remain protective of the lake's designation as a public water supply; and

2) There will be a very positive socio-economic benefit nationwide and to the Northwest Indiana area from the project's implementation.

Based on this analysis, it is recommended that IDEM determine that the antidegradation standard is satisfied through implementation of limits for TSS and Ammonia-N based on the currently applicable federal effluent limitation guidelines (ELGs).

TABLES

TABLE 1. BP WHITING REFINERY MAXIMUM MONTHLY PRODUCTION DATA - EXISTING CONFIGURATION

EPA PROCESS NO.	EPA PROCESS NAME	BP Whiting Process Rate (1000 Bbl/d)	WEIGHTING FACTOR (See Below)	PROCESS RATE / FEEDSTOCK RATE	UNIT PROCESS CONFIGURATION FACTOR
	CRUDE PROCESSES				
1	Atmospheric Crude Distillation	420.6		1.000	
2	Crude Desalting	420.6		1.000	
3	Vacuum Crude Distillation	216.9		0.516	
	Sum	**1058.1**	**1**	**2.516**	**2.516**
	CRACKING AND COKING PROCESSES				
6	Fluid Catalytic Cracking	169.2		0.402	
15	Delayed Coking	31.9		0.076	
54	Hydrotreating	129.4		0.308	
	Sum	**330.5**	**6**	**0.786**	**4.715**
	ASPHALT PROCESSES				
18	Asphalt Production	54.7		0.130	
	Sum	**54.7**	**12**	**0.130**	**1.561**
	REFORMING AND ALKYLATION PROCESSES				
8	Sulfuric Acid Alkylation	20.0			
12	Catalytic Reforming	84.4			
	Sum	**104.4**			
	FEEDSTOCK RATE (1,000 Bbl/d)		**420.6**	**TOTAL**	**8.79**

NOTES:
(a) Maximum monthly average feedstock rate was in August 1997.

(1) WEIGHTING FACTOR
Based on the table in 40 CFR 419.42 (b) (3)

(2) SIZE FACTOR
Based on the table in 40 CFR 419.22 (b) (1), 419.23 (b) (1), or 419.24 (b) (1)

1,000 BBL OF FEEDSTOCK PER STREAM DAY	SIZE FACTOR
150.0 or greater	1.41

(3) PROCESS FACTOR
Based on the table in 40 CFR 419.22 (b) (2), 419.23 (b) (2), or 419.24 (b) (2)

PROCESS CONFIGURATION FACTOR	PROCESS FACTOR
8.5 to 8.99	1.67

TABLE 2. CALCULATION OF BP WHITING REFINERY LIMITS BY BPT, BAT AND BCT - EXISTING CONFIGURATION

POLLUTANT	TYPE OF EFFLUENT LIMITATION (a)	DAILY MAXIMUM (lbs/1,000 Bbl of Feedstock)	MONTHLY AVERAGE (lbs/1,000 Bbl of Feedstock)	SIZE FACTOR	PROCESS FACTOR	FEEDSTOCK RATE (1,000 Bbl of Feedstock)	EFFLUENT LIMITATIONS BY BPT, BAT, & BCT		OTHER BAT EFFLUENT LIMITATIONS (c)		CONTROLLING EFFLUENT LIMITATIONS	
							DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)	DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)	DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)
BOD5	BPT, BCT	9.9	5.5	1.41	1.67	420.6	9,804.83	5,447.13			**9,804.83**	**5,447.13**
TSS	BPT, BCT	6.9	4.4	1.41	1.67	420.6	6,833.67	4,357.70			**6,833.67**	**4,357.70**
COD	BPT, BAT	74.0	38.4	1.41	1.67	420.6	73,288.62	38,030.85			**73,288.62**	**38,030.85**
Oil and Grease	BPT, BCT	3.0	1.6	1.41	1.67	420.6	2,971.16	1,584.62			**2,971.16**	**1,584.62**
Phenolic Compounds	BPT	0.074	0.036	1.41	1.67	420.6	73.29	35.65	80.44	19.45	**73.29**	**19.45**
Ammonia as N	BPT, BAT	6.6	3.0	1.41	1.67	420.6	6,536.55	2,971.16			**6,536.55**	**2,971.16**
Sulfide	BPT, BAT	0.065	0.029	1.41	1.67	420.6	64.38	28.72			**64.38**	**28.72**
Total Chromium	BPT	0.15	0.088	1.41	1.67	420.6	148.56	87.15	65.64	22.85	**65.64**	**22.85**
Hexavalent Chromium	BPT	0.012	0.0056	1.41	1.67	420.6	11.88	5.55	4.20	1.87	**4.20**	**1.87**
pH	BPT, BCT	(b)	(b)	(b)	(b)	(b)	6.0 - 9.0	6.0 - 9.0			**6.0 - 9.0**	**6.0 - 9.0**

NOTES:
(a) Based on 40 CFR 419.22 (a), 419.23 (a), and 419.24 (a).
(b) Within the range 6.0 to 9.0 s.u.
(c) Based on 40 CFR 419.23 (c) (1) (i)

TABLE 3. OTHER BP WHITING REFINERY LIMITS CALCULATED BY BAT (a) - EXISTING CONFIGURATION

POLLUTANT	PROCESSES INCLUDED	DAILY MAXIMUM (lbs/1,000 Bbl of Feedstock)	MONTHLY AVERAGE (lbs/1,000 Bbl of Feedstock)	FEEDSTOCK RATE (1,000 Bbl of Feedstock)	EFFLUENT LIMITS	
					DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)
Phenolic Compounds	Crude	0.013	0.003	1,058.1	13.76	3.17
	Cracking & Coking	0.147	0.036	330.5	48.58	11.90
	Asphalt	0.079	0.019	54.7	4.32	1.04
	Reforming & Alkylation	0.132	0.032	104.4	13.78	3.34
					80.44	19.45
Total Chromium	Crude	0.011	0.004	1,058.1	11.64	4.23
	Cracking & Coking	0.119	0.041	330.5	39.33	13.55
	Asphalt	0.064	0.022	54.7	3.50	1.20
	Reforming & Alkylation	0.107	0.037	104.4	11.17	3.86
					65.64	22.85
Hexavalent Chromium	Crude	0.0007	0.0003	1,058.1	0.74	0.32
	Cracking & Coking	0.0076	0.0034	330.5	2.51	1.12
	Asphalt	0.0041	0.0019	54.7	0.22	0.10
	Reforming & Alkylation	0.0069	0.0031	104.4	0.72	0.32
					4.20	1.87

NOTES:
(a) Based on 40 CFR 419.23 (c) (1) (i)

TABLE 4: CURRENT NPDES LIMITS FOR BP WHITING REFINERY

POLLUTANT	CURRENT NPDES PERMIT EFFLUENT LIMITATIONS	
	DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)
BOD_5	8,164	4,161
TSS	5,694	3,646
COD	58,427	30,323
Oil and Grease	2,600	1,368
Phenolic Compounds	73.01	20.33
Ammonia as N	2,060	1,030
Sulfide	51.4	23.1
Total Chromium	68.53	23.90
Hexavalent Chromium	4.48	2.01
pH	6.0 - 9.0	6.0 - 9.0

TABLE 5. BP WHITING REFINERY MAXIMUM MONTHLY PRODUCTION DATA - CXHO CONFIGURATION

CHXO CONFIGURATION

EPA PROCESS NO.	EPA PROCESS NAME	BP Whiting Process Rate (1000 Bbl/d)	WEIGHTING FACTOR (See Below)	PROCESS RATE / FEEDSTOCK RATE	UNIT PROCESS CONFIGURATION FACTOR
	CRUDE PROCESSES				
1	Atmospheric Crude Distillation	420.0		1.000	
2	Crude Desalting	420.0		1.000	
3	Vacuum Crude Distillation	240.3		0.572	
	Sum	**1080.3**	**1**	**2.572**	**2.572**
	CRACKING AND COKING PROCESSES				
6	Fluid Catalytic Cracking	172.0		0.410	
15	Delayed Coking	102.0		0.243	
54	Hydrotreating	441.3		1.051	
	Sum	**715.3**	**6**	**1.703**	**10.219**
	ASPHALT PROCESSES				
18	Asphalt Production	33.9		0.081	
	Sum	**33.9**	**12**	**0.081**	**0.969**
	REFORMING AND ALKYLATION PROCESSES				
8	Sulfuric Acid Alkylation	29.0			
12	Catalytic Reforming	70.0			
	Sum	**99.0**			
	FEEDSTOCK RATE (1,000 Bbl/d)		**420.0**	**TOTAL**	**13.76**

NOTES:

(1) WEIGHTING FACTOR
Based on the table in 40 CFR 419.42 (b) (3)

(2) SIZE FACTOR
Based on the table in 40 CFR 419.22 (b) (1), 419.23 (b) (1), or 419.24 (b) (1)

1,000 BBL OF FEEDSTOCK PER STREAM DAY	SIZE FACTOR
150.0 or greater	**1.41**

Based on the table in 40 CFR 419.22 (b) (2), 419.23 (b) (2), or 419.24 (b) (2)

PROCESS CONFIGURATION FACTOR	PROCESS FACTOR
9.5 or greater	**1.89**

TABLE 6. CALCULATION OF BP WHITING REFINERY LIMITS BY BPT, BAT AND BCT - CHXO CONFIGURATION

POLLUTANT	TYPE OF EFFLUENT LIMITATION (a)	DAILY MAXIMUM (lbs/1,000 Bbl of Feedstock)	MONTHLY AVERAGE (lbs/1,000 Bbl of Feedstock)	SIZE FACTOR	PROCESS FACTOR	FEEDSTOCK RATE (1,000 Bbl of Feedstock)	EFFLUENT LIMITATIONS BY BPT, BAT, & BCT		OTHER BAT EFFLUENT LIMITATIONS (c)		CONTROLLING EFFLUENT LIMITATIONS	
							DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)	DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)	DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)
BOD5	BPT, BCT	9.9	5.5	1.41	**1.89**	420.0	11,080.65	6,155.92			**11,081**	**6,156**
TSS	BPT, BCT	6.9	4.4	1.41	**1.89**	420.0	7,722.88	4,924.74			**7,723**	**4,925**
COD	BPT, BAT	74.0	38.4	1.41	**1.89**	420.0	82,825.09	42,979.51			**82,825**	**42,980**
Oil and Grease	BPT, BCT	3.0	1.6	1.41	**1.89**	420.0	3,357.77	1,790.81			**3,358**	**1,791**
Phenolic Compounds	BPT	0.074	0.036	1.41	**1.89**	420.0	82.83	40.29	134.94	32.80	**82.83**	**32.80**
Ammonia as N	BPT, BAT	6.6	3.0	1.41	**1.89**	420.0	7,387.10	3,357.77			**7,387**	**3,358**
Sulfide	BPT, BAT	0.065	0.029	1.41	**1.89**	420.0	72.75	32.46			**72.8**	**32.5**
Total Chromium	BPT	0.15	0.088	1.41	**1.89**	420.0	167.89	98.49	109.77	38.06	**109.8**	**38.1**
Hexavalent Chromium	BPT	0.012	0.0056	1.41	**1.89**	420.0	13.43	6.27	7.01	3.13	**7.01**	**3.13**
pH	BPT, BCT	(b)	(b)	(b)	(b)	(b)	6.0 - 9.0	6.0 - 9.0			**6.0 - 9.0**	**6.0 - 9.0**

NOTES:
(a) Based on 40 CFR 419.22 (a), 419.23 (a), and 419.24 (a).
(b) Within the range 6.0 to 9.0 s.u.
(c) Based on 40 CFR 419.23 (c) (1) (i)

TABLE 7. OTHER BP WHITING REFINERY LIMITS CALCULATED BY BAT (a) - CHXO CONFIGURATION

POLLUTANT	PROCESSES INCLUDED	DAILY MAXIMUM (lbs/1,000 Bbl of Feedstock)	MONTHLY AVERAGE (lbs/1,000 Bbl of Feedstock)	FEEDSTOCK RATE (1,000 Bbl of Feedstock)	EFFLUENT LIMITS	
					DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)
Phenolic Compounds	Crude	0.013	0.003	1,080.3	14.04	3.24
	Cracking & Coking	0.147	0.036	715.3	105.15	25.75
	Asphalt	0.079	0.019	33.9	2.68	0.64
	Reforming & Alkylation	0.132	0.032	99.0	13.07	3.17
					134.94	32.80
Total Chromium	Crude	0.011	0.004	1,080.3	11.88	4.32
	Cracking & Coking	0.119	0.041	715.3	85.12	29.33
	Asphalt	0.064	0.022	33.9	2.17	0.75
	Reforming & Alkylation	0.107	0.037	99.0	10.59	3.66
					109.77	38.06
Hexavalent Chromium	Crude	0.0007	0.0003	1,080.3	0.76	0.32
	Cracking & Coking	0.0076	0.0034	715.3	5.44	2.43
	Asphalt	0.0041	0.0019	33.9	0.14	0.06
	Reforming & Alkylation	0.0069	0.0031	99.0	0.68	0.31
					7.01	3.13

NOTES:
(a) Based on 40 CFR 419.23 (c) (1) (i)

TABLE 8. SUMMARY OF BP WHITING REFINERY LAKEFRONT WWTP OUTFALL 001 PERMIT LIMITS

POLLUTANT	CURRENT NPDES PERMIT EFFLUENT LIMITATIONS (a)		CXHO CONFIG PROJECTED EFFLUENT LIMITATIONS (b)		CXHO PROJECTED VERSUS PERMIT (b)	
	DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)	DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)	DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)
BOD_5	8,164	4,161	11,081	6,156	36%	48%
TSS	5,694	3,646	7,723	4,925	36%	35%
COD	58,427	30,323	82,825	42,980	42%	42%
Oil and Grease	2,600	1,368	3,358	1,791	29%	31%
Phenolic Compounds	73.01	20.33	82.8	32.8	13%	61%
Ammonia as N	2,060	1,030	7,387	3,358	259%	226%
Sulfide	51.4	23.1	72.8	32.5	42%	41%
Total Chromium	68.53	23.90	109.8	38.1	60%	59%
Hexavalent Chromium	4.48	2.01	7.01	3.13	57%	56%
pH	6.0 - 9.0	6.0 - 9.0	6.0 - 9.0	6.0 - 9.0	6.0 - 9.0	6.0 - 9.0

NOTES:
(a) Based on 40 CFR 419 Subpart D (Lube)
(b) Based on 40 CFR 419 Subpart B (Cracking)

TABLE 9. BP TOLEDO SOURCE SAMPLING RESULTS- 2006

	Mar-06		May-06			Average		
	Crude I (CXHO) PS Brine	Crude II (Non-CXHO) PS Brine	Crude I Brine [1]	Crude I Brine [2]	Crude II Brine	Crude I Brine	Crude II Brine	% Change w/CXHO Crudes
Flow (gpm)			75	75	61	75	61	123%
Selenium (Total) (ug/L)	**7.41**	13.4	21.3	19	**12.4**	14	13	111%
Selenium (Dissolved*) (µg/L)			3.98	12.7	14.6	4	15	27%
Nickel (Total) (ug/L)	430	19.4	394.0	697.0	119.0	412	69	595%
Nickel (Dissolved*) (µg/L)			3.59	24.9	8.62	4	9	42%
Vanadium (Total) (µg/L)	410	**3.23**	611	980	**41.6**	511	22	2277%
Vanadium (Dissolved*) (µg/L)			10.1	72.9	**10.3**	10.1	10.3	98%
COD (mg/L)	29,000	1,700	14,000	54,000	7,900	21,500	4,800	
Phenolics (mg/L)	4.53	4.46				4.53	4.46	102%
Ammonia-N (mg/L)	5.8	12	12	12	11	9	12	77%
TKN (mg/L)			66	98	56	66	56	118%
Nitrate-N (mg/L)	18.5	3.00	2.24	2.48	***<0.0356***	10	3	346%
H2S (Reactive Sulfide) (mg/L)			150	120	140	150	140	107%
Cyanide (Total) (mg/L)			***<0.00885***	0.0128	***<0.00885***			
Oil and Grease (mg/L)			7,000	18,000	2,700	7,000	2,700	259%
TSS (mg/L)	1,600	15	3,600	2,200	780	2,600	398	654%

Typical Refinery COD/BOD_5= 1.5

Calculated BOD_5 (mg/L)	19,333	1,133	9,333	36,000	5,267	14,333	3,200	448%

NOTES: -- = Not Sampled For

Bold = Estimated (Less Than Reporting Limit)

<Bold = Less Than Method Detection Limit

[1] Sample collected May 10, 2006

[2] Sample collected during mudwash, May 12, 2006, not used in determination of the average

* Dissolved generated by filtering thru a 10 µm filter

TABLE 10. BP WHITING LAKEFRONT WWTP CXHO NITROGEN EVALUATION

2003-2005 Operations			Post CXHO		
Organic Loading					
Typical Refinery COD/BOD=	1.5		Typical Refinery COD/BOD=	1.5	
AFU Effluent COD=	26,887	lbs/d	2003-2005 AFU Effluent COD=	26,887	lbs/d
Estimated AFU Eff BOD=	17,925	lbs/d	Expected COD Increase w/CXHO=	42%	
Effluent to Lake BOD=	255	lbs/d	Estimated AFU Eff COD=	38,169	lbs/d
BOD Removal=	99%		Estimated AFU Eff BOD=	25,446	lbs/d
BOD Removed=	17,669	lbs/d	2003-2005 BOD Removal=	99%	
			Estimated Effluent to Lake BOD=	362	lbs/d
			Estimated BOD Removed=	25,084	lbs/d
Nitrogen Requirements					
lbs N / lbs BOD Req'd for Bio=	0.05	lbs	lbs N / lbs BOD Req'd for Bio=	0.05	lbs
BOD Removed=	17,669	lbs/d	Estimated BOD Removed=	25,084	lbs/d
Nitrogen Req'd for Bio=	883	lbs/d	Nitrogen Req'd for Bio=	1,254	lbs/d
Nitrogen Loading					
March 2006 SWS bottoms NH3-N=	32	mg/L	NH_3-N from other refinery processes=	1,420	lbs/d
March 2006 SWS bottoms flow=	700	gpm			
March 2006 SWS bottoms NH3-N=	269	lbs/d	SWS bottoms NH_3-N=	30	mg/L
			SWS bottoms flow=	2,500	gpm
May 2006 SWS bottoms NH3-N=	24	mg/L	SWS bottoms NH_3-N=	900	lbs/d
May 2006 SWS bottoms flow=	790	gpm			
May 2006 SWS bottoms NH3-N=	228	lbs/d	Estimated NH3-N loading=	2,320	lbs/d
Avg SWS BottomsNH3-N=	248	lbs/d			
7 Sep Effluent Nitrogen=	1,668	lbs/d			
NH3-N from other refinery processes=	1,420	lbs/d			
Nitrification					
Nitrogen Loading=	1,668	lbs/d	Estimated Nitrogen Loading=	2,320	lbs/d
Nitrogen Req'd for Bio=	883	lbs/d	Nitrogen Req'd for Bio=	1,254	lbs/d
Available N for Nitrification=	784	lbs/d	Available N for Nitrification=	1,066	lbs/d
Nitrogen in Effluent to Lake=	76	lbs/d	2003-2005 Percent Nitrification=	90%	lbs/d
Percent Nitrification=	90%		Estimated Nitrogen in Effluent to Lake=	103	lbs/d
Nitrogen Nitrified=	709	lbs/d	Nitrogen Nitrified=	963	lbs/d
lbs Oxygen per lb BOD=	1.2	lb/lb	lbs Oxygen per lb BOD=	1.2	lb/lb
Oxygen Req'd for Bio=	21,203	lbs/d	Oxygen Req'd for Bio=	30,100	lbs/d
Oxygen Req'd for Nitrification=	4.57	lbs O_2/lb	Oxygen Req'd for Nitrification=	4.57	lbs O_2/lb
Oxygen Req'd for Nitrification=	3,240	lbs/d	Oxygen Req'd for Nitrification=	4,401	lbs/d
Total Oxygen Required=	24,443	lbs/d	Total Oxygen Required=	34,501	lbs/d
Alkalinity Req'd for Nitrification=	7.14	lbs/lb	Alkalinity Req'd for Nitrification=	7.14	lbs/lb
Alkalinity Req'd for Nitrification=	5,062	lbs/ld	Alkalinity Req'd for Nitrification=	6,876	lbs/ld
Nitrate-Nitrogen					
Nitrogen Nitrified=	709	lbs/d	Nitrogen Nitrified=	963	lbs/d
Effluent Nitrate-Nitrogen=	709	lbs/d	Effluent Nitrate-Nitrogen=	963	lbs/d
Effluent to Lake=	15.2	mgd	Effluent to Lake=	21.4	mgd
Effluent Nitrate-Nitrogen=	**6**	mg/L	Effluent Nitrate-Nitrogen=	**5**	mg/L

TABLE 11. BP WHITING LAKEFRONT WWTP CXHO NITROGEN EVALUATION (MODIFIED WITH 2001-2002 MAX MONTHLY AVERAGE

2001-2002 Operations			Post CXHO		
Organic Loading					
Typical Refinery COD/BOD=	1.5		Typical Refinery COD/BOD=	1.5	
AFU Effluent COD=	26,887	lbs/d	2001-2002 AFU Effluent COD=	26,887	lbs/d
Estimated AFU Eff BOD=	17,925	lbs/d	Expected COD Increase w/CXHO=	42%	
Effluent to Lake BOD=	790	lbs/d	Estimated AFU Eff COD=	38,169	lbs/d
BOD Removal=	96%		Estimated AFU Eff BOD=	25,446	lbs/d
BOD Removed=	17,135	lbs/d	2001-2002 BOD Removal=	96%	
			Estimated Effluent to Lake BOD=	1,121	lbs/d
			Estimated BOD Removed=	24,325	lbs/d
Nitrogen Requirements					
lbs N / lbs BOD Req'd for Bio=	0.05	lbs	lbs N / lbs BOD Req'd for Bio=	0.05	lbs
BOD Removed=	17,135	lbs/d	Estimated BOD Removed=	24,325	lbs/d
Nitrogen Req'd for Bio=	857	lbs/d	Nitrogen Req'd for Bio=	1,216	lbs/d
Nitrogen Loading					
March 2006 SWS bottoms NH3-N=	32	mg/L	NH_3-N from other refinery processes=	1,420	lbs/d
March 2006 SWS bottoms flow=	700	gpm			
March 2006 SWS bottoms NH3-N=	269	lbs/d	SWS bottoms NH_3-N=	30	mg/L
			SWS bottoms flow=	2,500	gpm
May 2006 SWS bottoms NH3-N=	24	mg/L	SWS bottoms NH_3-N=	900	lbs/d
May 2006 SWS bottoms flow=	790	gpm			
May 2006 SWS bottoms NH3-N=	228	lbs/d	Estimated NH_3-N loading=	2,320	lbs/d
Avg SWS BottomsNH3-N=	248	lbs/d			
7 Sep Effluent Nitrogen=	1,668	lbs/d			
NH3-N from other refinery processes=	1,420	lbs/d			
Nitrification					
Nitrogen Loading=	1,668	lbs/d	Estimated Nitrogen Loading=	2,320	lbs/d
Nitrogen Req'd for Bio=	857	lbs/d	Nitrogen Req'd for Bio=	1,216	lbs/d
Available N for Nitrification=	811	lbs/d	Available N for Nitrification=	1,104	lbs/d
Nitrogen in Effluent to Lake=	502	lbs/d	2001-2002 Percent Nitrification=	38%	lbs/d
Percent Nitrification=	38%		Estimated Nitrogen in Effluent to Lake=	683	lbs/d
Nitrogen Nitrified=	309	lbs/d	Nitrogen Nitrified=	421	lbs/d
lbs Oxygen per lb BOD=	1.2	lb/lb	lbs Oxygen per lb BOD=	1.2	lb/lb
Oxygen Req'd for Bio=	20,562	lbs/d	Oxygen Req'd for Bio=	29,190	lbs/d
Oxygen Req'd for Nitrification=	4.57	lbs O_2/lb	Oxygen Req'd for Nitrification=	4.57	lbs O_2/lb
Oxygen Req'd for Nitrification=	1,413	lbs/d	Oxygen Req'd for Nitrification=	1,922	lbs/d
Total Oxygen Required=	21,975	lbs/d	Total Oxygen Required=	31,112	lbs/d
Alkalinity Req'd for Nitrification=	7.14	lbs/lb	Alkalinity Req'd for Nitrification=	7.14	lbs/lb
Alkalinity Req'd for Nitrification=	2,207	lbs/ld	Alkalinity Req'd for Nitrification=	3,003	lbs/ld
Nitrate-Nitrogen					
Nitrogen Nitrified=	309	lbs/d	Nitrogen Nitrified=	421	lbs/d
Effluent Nitrate-Nitrogen=	309	lbs/d	Effluent Nitrate-Nitrogen=	421	lbs/d
Effluent to Lake=	15.2	mgd	Effluent to Lake=	21.4	mgd
Effluent Nitrate-Nitrogen=	**2**	mg/L	Effluent Nitrate-Nitrogen=	**2**	mg/L

TABLE 12. BP WHITING LAKEFRONT WWTP CXHO NITROGEN EVALUATION (MODIFIED WITH 2001-2002 LONG TERM AVERAGE)

2001-2002 Operations			Post CXHO		
Organic Loading					
Typical Refinery COD/BOD=	1.5		Typical Refinery COD/BOD=	1.5	
AFU Effluent COD=	26,887	lbs/d	2001-2002 AFU Effluent COD=	26,887	lbs/d
Estimated AFU Eff BOD=	17,925	lbs/d	Expected COD Increase w/CXHO=	42%	
Effluent to Lake BOD=	489	lbs/d	Estimated AFU Eff COD=	38,169	lbs/d
BOD Removal=	97%		Estimated AFU Eff BOD=	25,446	lbs/d
BOD Removed=	17,436	lbs/d	2001-2002 BOD Removal=	97%	
			Estimated Effluent to Lake BOD=	694	lbs/d
			Estimated BOD Removed=	24,752	lbs/d
Nitrogen Requirements					
lbs N / lbs BOD Req'd for Bio=	0.05	lbs	lbs N / lbs BOD Req'd for Bio=	0.05	lbs
BOD Removed=	17,436	lbs/d	Estimated BOD Removed=	24,752	lbs/d
Nitrogen Req'd for Bio=	872	lbs/d	Nitrogen Req'd for Bio=	1,238	lbs/d
Nitrogen Loading					
March 2006 SWS bottoms NH3-N=	32	mg/L	NH_3-N from other refinery processes=	1,420	lbs/d
March 2006 SWS bottoms flow=	700	gpm			
March 2006 SWS bottoms NH3-N=	269	lbs/d	SWS bottoms NH_3-N=	30	mg/L
			SWS bottoms flow=	2,500	gpm
May 2006 SWS bottoms NH3-N=	24	mg/L	SWS bottoms NH_3-N=	900	lbs/d
May 2006 SWS bottoms flow=	790	gpm			
May 2006 SWS bottoms NH3-N=	228	lbs/d	Estimated NH_3-N loading=	2,320	lbs/d
Avg SWS BottomsNH3-N=	248	lbs/d			
7 Sep Effluent Nitrogen=	1,668	lbs/d			
NH3-N from other refinery processes=	1,420	lbs/d			
Nitrification					
Nitrogen Loading=	1,668	lbs/d	Estimated Nitrogen Loading=	2,320	lbs/d
Nitrogen Req'd for Bio=	872	lbs/d	Nitrogen Req'd for Bio=	1,238	lbs/d
Available N for Nitrification=	796	lbs/d	Available N for Nitrification=	1,082	lbs/d
Nitrogen in Effluent to Lake=	117	lbs/d	2001-2002 Percent Nitrification=	85%	lbs/d
Percent Nitrification=	85%		Estimated Nitrogen in Effluent to Lake=	159	lbs/d
Nitrogen Nitrified=	679	lbs/d	Nitrogen Nitrified=	923	lbs/d
lbs Oxygen per lb BOD=	1.2	lb/lb	lbs Oxygen per lb BOD=	1.2	lb/lb
Oxygen Req'd for Bio=	20,923	lbs/d	Oxygen Req'd for Bio=	29,702	lbs/d
Oxygen Req'd for Nitrification=	4.57	lbs O_2/lb	Oxygen Req'd for Nitrification=	4.57	lbs O_2/lb
Oxygen Req'd for Nitrification=	3,104	lbs/d	Oxygen Req'd for Nitrification=	4,219	lbs/d
Total Oxygen Required=	24,026	lbs/d	Total Oxygen Required=	33,921	lbs/d
Alkalinity Req'd for Nitrification=	7.14	lbs/lb	Alkalinity Req'd for Nitrification=	7.14	lbs/lb
Alkalinity Req'd for Nitrification=	4,849	lbs/ld	Alkalinity Req'd for Nitrification=	6,591	lbs/ld
Nitrate-Nitrogen					
Nitrogen Nitrified=	679	lbs/d	Nitrogen Nitrified=	923	lbs/d
Effluent Nitrate-Nitrogen=	679	lbs/d	Effluent Nitrate-Nitrogen=	923	lbs/d
Effluent to Lake=	15.2	mgd	Effluent to Lake=	21.4	mgd
Effluent Nitrate-Nitrogen=	**5**	mg/L	Effluent Nitrate-Nitrogen=	**5**	mg/L

TABLE 13. POST CXHO EFFLUENT PROJECTION AND COMPARISON TO CURRENT NPDES LIMITS

POLLUTANT	CURRENT NPDES PERMIT EFFLUENT LIMITATIONS		BP WHITING LAKEFRONT OPERATIONS									PROJECTED POST-CXHO BP WHITING LAKEFRONT OPERATIONS													
			2003-2005 (LONG TERM AVERAGE)			2001-2002 (DAILY MAX)		2001-2002 (MAX MO AVERAGE)		2001-2002 (LONG TERM AVERAGE)		(USING 2003-2005 DATA)			(USING 2001-2002 MAX MONTLY AVERAGE)		(USING 2001-2002 LONG TERM AVERAGE)		Toledo CXHO Operations Analysis Applied to the Removal Efficiency of 2001-2002 Whiting Max Monthly Avg			CXHO Refinery Configuration Monthly Avg TBEL change Applied to the Removal Efficiency of 2001-2002 Whiting Max Monthly Avg		
	DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)	INFLUENT (lbs/day)	EFFLUENT (lbs/day)	REMOVAL EFF (%)	EFFLUENT (lbs/day)	REMOVAL EFF [1] (%)	EFFLUENT (lbs/day)	REMOVAL EFF [1] (%)	EFFLUENT (lbs/day)	REMOVAL EFF [1] (%)	PROJECTED INFLUENT [2] (lbs/day)	PROJECTED EFFLUENT (lbs/day)	% OF EXISTING MO AVG LIMIT	PROJECTED EFFLUENT (lbs/day)	% OF EXISTING MO AVG LIMIT	PROJECTED EFFLUENT (lbs/day)	% OF EXISTING MO AVG LIMIT	PROJECTED EFFLUENT (%)	PROJECTED EFFLUENT (lbs/day)	% OF EXISTING MO AVG LIMIT	PROJECTED INCREASE (%)	PROJECTED EFFLUENT (lbs/day)	PERCENT OF MO AVG LIMIT
BOD_5	8,164	4,161	17,925	255	99%	3,615	80%	790	96%	489	97%	25,446	362	9%	1,121	27%	694	17%	448%	3,539	85%	48%	1,169	28%
TSS	5,694	3,646	21,169	1,787	92%	5,041	76%	2,975	86%	1,748	92%								654%	19,459	534%	35%	4,018	110%
COD	58,427	30,323	26,887	5,914	78%	16,763	38%	11,323	58%	7,688	71%	38,169	544	2%	1,682	6%	1,041	3%	448%	50,718	167%	42%	16,049	53%
Oil and Grease	2,600	1,368	5,316	134	97%	1,154	78%	524	90%	227	96%								259%	1,359	99%	31%	686	50%
Phenolic Compounds	73.01	20.33		< 1.26		4.90		< 2.01		< 1.39									102%	4.05	20%	61%	6.5	32%
Ammonia as N	2,060	1,030	1,668	76	95%	1,852	-11%	502	70%	117	93%	2,320	103	10%	683	66%	159	15%				226%	1,637	159%
Sulfide	51.4	23.1		5.75		22.6		9.49		4.12									107%	19.66	85%	41%	24.0	104%
Total Chromium	68.53	23.90		< 1.24		< 1.96		< 1.80		< 1.31												59%	3.55	15%
Hexavalent Chromium	4.48	2.01		< 0.62		< 0.98		< 0.90		< 0.69												56%	2.54	126%
pH	6.0 - 9.0	6.0 - 9.0																						

[1] Removal efficiency calculated using 2003-2005 average influent values. 2001-2002 influent values unavailable.
[2] If no influent data are available, then the percent increase is applied to the 2001-2002 Maximum Monthly Average.

TABLE 14. CONSERVATIVE POST-CXHO EFFLUENT PROJECTION AND COMPARISON TO CURRENT NPDES LIMITS

POLLUTANT	CURRENT NPDES PERMIT EFFLUENT LIMITATIONS		CONSERVATIVE EFFLUENT PROJECTION [1]		
	DAILY MAXIMUM (lbs/day)	MONTHLY AVERAGE (lbs/day)	PROJECTED EFFLUENT (lbs/day)	BASIS OF PROJECTION [2]	% OF EXISTING MO AVG LIMIT
BOD_5	8,164	4,161	3,539	Toledo	85%
TSS	5,694	3,646	19,459	Toledo	534%
COD	58,427	30,323	50,718	Toledo	167%
Oil and Grease	2,600	1,368	1,359	Toledo	99%
Phenolic Compounds	73.01	20.33	6.51	Config	32%
Ammonia as N	2,060	1,030	1,637	Config	159%
Sulfide	51.4	23.1	24.0	Config	104%
Total Chromium	68.53	23.90	3.55	Config	15%
Hexavalent Chromium	4.48	2.01	2.54	Config	126%
pH	6.0 - 9.0	6.0 - 9.0			

[1] Projected effluent determined from the maximum projected effluent on Table 13

[2] Organic and Nutrient Loading Model ("Loading" - Tables 10, 11, and 12), Toledo Operations Model ("Toledo" - Table 9), or Refinery Configuration Change ("Config" - Table 5)

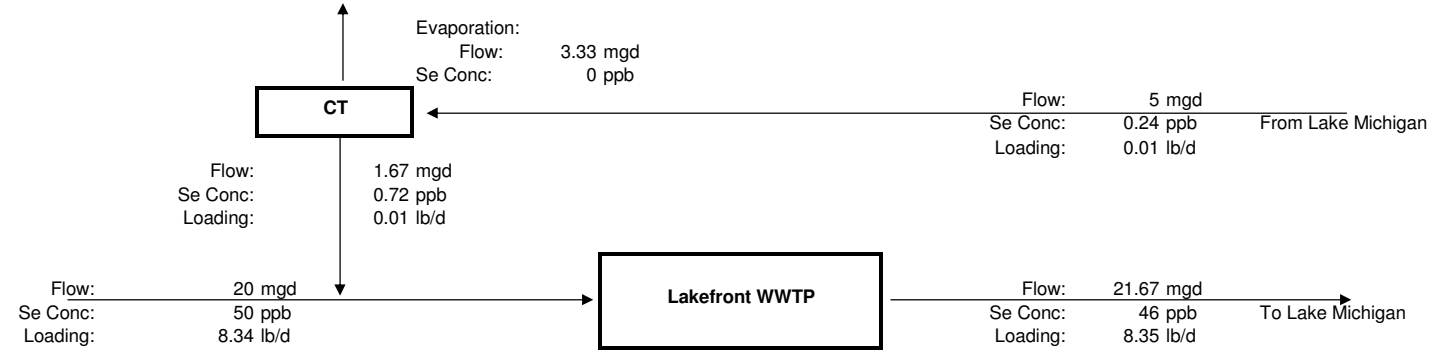
TABLE 15. PROJECTS THAT WILL BE IMPLEMENTED AS PART OF CXHO CONFIGURATION

Unit	Description	Total Estimated Cost
Desalter Brine Treatment	Treatment system to remove emuslified solids from the brine prior to discharge to process sewer.	$17,000,000
API Separators	Repairs/upgrades to API oil-water separator to improve reliability.	$13,000,000
Sour Water Strippers	Provide sufficient sour water stripping capacity for increased ammonia loading from the processing of the Canadian crudes	$37,000,000
Equalization/Storm Water Tank	Installation of an estimated 10 million gallon tank to provide additional equalization and storm water surge capacity.	$10,000,000
Final Filters	Upgrade of the final filters at the WWTP to improve hydraulics and reliability.	$12,000,000
Flow Reduction Projects	Implementation of process wastewater reduction projects to maintain Outfall 001 flow at 21.4 mgd.	$1,000,000
Total Estimated Capital Costs		**$90,000,000**

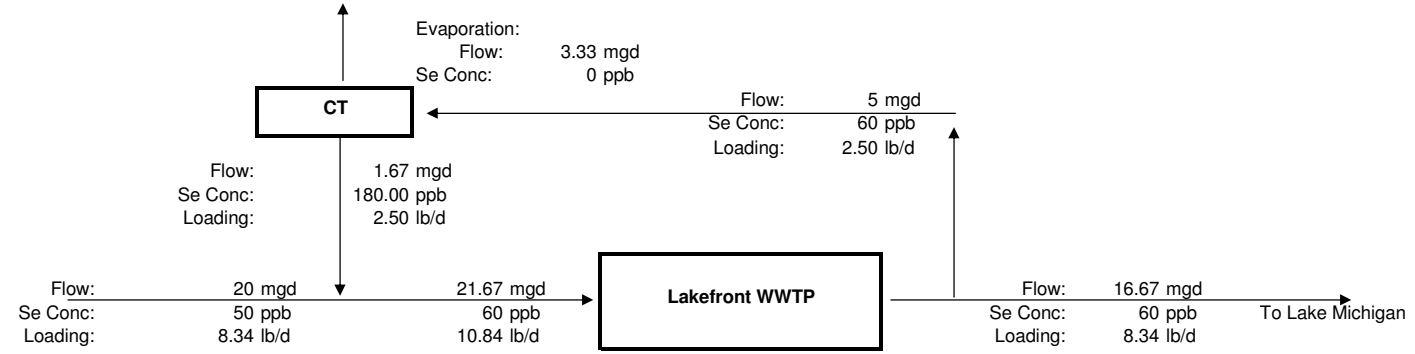
FIGURE

Assumptions:
No. of Cycles 3

Scenario 1: Cooling Tower Make-up From Lake Michigan



Scenario 2: Cooling Tower Make-up From Effluent to Lake Michigan (ETL)



Prepared for:

bp

BP WHITING BUSINESS UNIT
WHITING, INDIANA

Prepared by:

ADVENT ENVIRON

FIGURE

COMPARISON OF SELENIUM EFFLUENT CHARACTERISTICS AS A FUNCTION OF COOLING TOWER MAKE-UP SOURCE

ATTACHMENT I

History of ELG Implementation at BP Whiting Refinery

HISTORY OF BP WHITING TBELS (ALL UNITS IN LB/DAY)

Doc #1 – August 27, 1974 Draft NPDES Permit

	Interim limits (till 6/30/77)		Final limits	
BOD_5	2,800 MA	6,800 DM	2,800 MA	6,800 DM
TSS	3,500 MA	7,000 DM	3,121 MA	5,281 DM
COD	31,690 MA	168,000 DM	31,690 MA	60,670 DM
O&G	2,200 MA	5,400 DM	1,440 MA	2,737 DM
Phenols	180 MA	480 DM	31 MA	64 DM
Ammonia	900 MA	1,200 DM	900 MA	1,200 DM
Sulfide	Report	Report	25 MA	57 DM
Total Cr	Report	Report	77 MA	131 DM
Hex Cr	Report	Report	1.3 MA	2.8 DM

No basis for limits found, as the accompanying Fact Sheet only re-presented the interim and final limits (no ELG or WQBEL calculations). Average flows in Fact Sheet were 29 mgd for Outfall 001 and 99 mgd for Outfall 002.

Doc #2 - October 10, 1974 Letter from Amoco to Indiana SPCB

Presents increased crude running capacity of refinery during 1974 from 315,000 BPCD (328,000 BPSD) to 360,000 BPCD (375,000 BPSD) and requests NPDES allocations be increased by the ratio 360/315. This request apparently was granted as the November 18, 1974 Final NPDES Permit limits are 360/315 times the August 27, 1974 Draft NPDES Permit limits. Therefore, it can be inferred that the November 18, 1974 Final NPDES Permit limits are based on a refinery capacity of 360,000 BPCD.

Doc #3 – November 18, 1974 Final NPDES Permit (expiration date = July 31, 1979)

	Interim limits (till 6/30/77)		Final limits	
BOD_5	3,200 MA	7,775 DM	3,200 MA	7,775 DM
TSS	4,000 MA	8,000 DM	3,570 MA	6,040 DM
COD	36,230 MA	192,000 DM	36,230 MA	69,360 DM
O&G	2,515 MA	6,175 DM	1,650 MA	3,130 DM
Phenols	180 MA	550 DM	35 MA	73 DM
Ammonia	1,030 MA	1,370 DM	1,030 MA	1,370 DM
Sulfide	Report	Report	29 MA	65 DM
Total Cr	Report	Report	88 MA	150 DM
Hex Cr	Report	Report	1.5 MA	3.2 DM

No direct basis for limits found as no Fact Sheet with permit, however see Doc #2 above.

Doc #4 - November 25, 1974 Request for Adjudicatory Hearing

“The reason for this request are: (1) That the limitations for outfall serial number 001 (Part IA1 and IA3) are more restrictive than guideline values (May 9, 1974 Federal Register as amended October 17, 1974) for BOD5 and NH3-N, and imposition of these more restrictive limitations is not equitable to Amoco Oil; (2) the limitations for phenols

and total suspended solids for outfall serial No. 001 fail to take into account contaminants in the intake water and are not stated on a net basis; (3) the limitations for outfall 001 fail to take into consideration allocations for ballast water and storm runoff;…." "The issues proposed to be considered at the hearing are (1) the limitations contained in the permit are more restrictive than the latest guideline values and therefore result in inequitable treatment of the subject Amoco refinery, and (2) did the Agency act in an arbitrary and capricious fashion in establishing the limitations and requirements set out above."

Doc #5 - December 24, 1974 Residual Chlorine Analysis for NPDES Permit

This memo presents the DMR for December 1974 where the BOD5 limits are 5,029 MA and 9,892 DM with footnote "Allowable BOD values for winter months (Dec., Jan., Feb., and Mar.) agreed to by Indiana SPCB in meeting with Amoco held on September 13, 1974." Other parameter's limits are same as Nov 18, 1974 NPDES permit (interim).

Doc #6 - February 21, 1975 RCM Called LML

The EPA offered to increase BOD, TSS, and O&G limits to allow 819,000 gpd ballast credit.

	Interim limits (till 6/30/77)		**Final limits**	
Win BOD	54,995 MA	9,825 DM	4,995 MA	9,825 DM
Sum BOD_5	3,372 MA	8,103 DM	3,372 MA	8,103 DM
TSS	5,000 MA	10,000 DM	3,685 MA	6,237 DM
O&G	2,515 MA	7,000 DM	1,705 MA	3,233 DM

Doc #7 - July 29, 1975 Draft Stipulation

Revised November 18, 1974 Final NPDES Permit as follows:

	Interim limits (till 6/30/77)		**Final limits**	
Win BOD_5	4,995 MA	9,825 DM	4,995 MA	9,825 DM
Sum BOD_5	3,372 MA	8,103 DM	3,372 MA	8,103 DM
TSS	5,000 MA	10,000 DM	4,530 MA	7,082 DM
O&G	2,515 MA	7,000 DM	1,705 MA	3,233 DM
Ammonia	1,030 MA	2,060 DM	1,030 MA	2,060 DM
Hex Cr			6.0 MA	13.0 DM

Added to November 18, 1974 NPDES Permit: "During the periods of the sour water stripper outage, from the effective date until September 1, 1978, the Ammonia (as N) limitations based on the Effluent Guidelines and Standards for the Petroleum Refining Point Source Category (40 C.F.R. 419), 2187 pounds daily average and 4777 pounds daily maximum shall apply."

Doc #8 - December 22, 1975 Final NPDES Permit (expiration date = July 31, 1979)

Revised permit based on adjudicatory hearing and stipulation

	Interim limits (till 6/30/77)		Final limits	
Win BOD_5	4,995 MA	9,825 DM	4,995 MA	9,825 DM
Sum BOD+	3,372 MA	8,103 DM	3,372 MA	8,103 DM
TSS	5,000 MA	10,000 DM	4,530 MA	7,082 DM
COD	36,230 MA	192,000 DM	36,230 MA	69,360 DM
O&G	2,515 MA	7,000 DM	1,705 MA	3,233 DM
Phenols	205 MA	550 DM	35 MA	73 DM
Ammonia	1,030 MA	2,060 DM	1,030 MA	2,060 DM
Sulfide	Report	Report	29 MA	65 DM
Total Cr	Report	Report	88 MA	150 DM
Hex Cr	Report	Report	6.0 MA	13.0 DM

Includes sour water stripper language given in July 29, 1975 draft stipulation. No basis for limits found as no Fact Sheet with permit

Doc #9 - January 14, 1976 Compliance Monitoring Report

Data tabulation = most limits same as December 22, 1975 NPDES permit

Doc #10 – January 25, 1979 Permit renewal Application

Presented a petroleum refining production value of 500,000 bbl crude or partially refined feedstock (stream day). Flow values given in application were:

	Outfall 001(mgd)	Outfall 002 (mgd)
Maximum	26.4	119
Average	18.9	108.1
Minimum	14.9	88

Doc #11 - May 13, 1980 Final NPDES Permit (expiration date = September 30, 1980)

	Final limits	
BOD_5	5,220 MA	10,760 DM
TSS	4,590 MA	7,520 DM
COD	37,850 MA	76,340 DM
O&G	1,720 MA	3,430 DM
Phenols	35 MA	73 DM
Ammonia	1,030 MA	2,060 DM
Sulfide	30 MA	71 DM
Total Cr	92 MA	164 DM
Hex Cr	6 MA	14.4 DM

No basis for limits found as no Fact Sheet with permit

Doc # 12 - May 19, 1981 Permit Renewal Application

Presents production data: Whiting Refinery Capacity is 405,000 BSD (Short-Term = 463,400 BSD). Peak capacities are broken down by unit.

Flow values given in application were:

	Outfall 001(mgd)	Outfall 002 (mgd)
Daily Maximum	31.7	140.6
Maximum Monthly Average	28.7	131.8
Long Term Average	18.3	109.5

Doc #13 – March 29, 1985 Final NPDES Permit (expiration date = Feb 28, 1990)

	Final limits (same as calculated ELGs except as noted below)	
BOD_5	3,724 MA	7,320 DM
TSS	3,268 MA	5,104 DM
COD	27,200 MA	52,360 DM
O&G	1,226.8 MA	2,330.4 DM
Phenols	19.5 MA	73.0 DM
Ammonia	1,030 MA	2,060 DM
Sulfide	21.2 MA	47.2 DM
Total Cr	22.8 MA	65.6 DM
Hex Cr	1.9 MA	4.2 DM

Accompanying Fact Sheet presents the following information:

- Subcategorized as a Lube Refinery (Subpart D – Lube Subcategory of 40 CFR Part 419, Petroleum Refining Point Source Category promulgated October 18, 1982 for BOD5, TSS, COD, O&G, Ammonia, Sulfide)
- Part 419 guidelines were subsequently altered by the Petroleum Refinery Settlement agreement of April 17, 1984, effective May 1, 1984 for Phenols, Total Cr and Hex Cr
- Petrochemical operations account for 7% of total production
- Maximum short term capacity = 410,000 BPSD of feedstock (crude oil) fed to topping units
- Limitations are based on actual production (high month for October 1983 to September 1984 = 336,100 BPSD) instead on designed capacity
- Process Configuration Factor = 7.98
- Size Factor = 1.19
- Process Factor = 1.00
- Ballast credit given for BOD5, TSS, COD, O&G

- Phenols 73.0 DM limit retained from expiring permit. Calculated ELG was 80.46 DM
- "The limitations for Ammonia have been retained from the expiring permit at outfall 001 since they represent Water Quality Standards are more stringent than the limitations derived from the aforementioned regulations." This statement appears to be false as the limitations presented in Docs #2, #3, #4, and #7 do not refer to Water Quality Standards. Calculated ELGs were 1,520 MA and 3,320 DM
- Outfall 001 effluent flow = 14.4 mgd average and 29.5 mgd max
- Outfall 002 effluent flow = 115.0 mgd average and 130.0 mgd max

Doc #14 – May 13, 1985 Final NPDES Permit (expiration date = Feb 28, 1990)

Revised March 29, 1985 Final NPDES Permit as follows:

	Final limits (same as calculated ELGS except as noted below)	
BOD5	4,161 MA	8,164 DM
TSS	3,646 MA	5,694 DM
COD	30,323 MA	58,427 DM
O&G	1,368 MA	2,600 DM
Phenols	20.33 MA	73.0 DM
Ammonia	1,030 MA	2,060 DM
Sulfide	23.1 MA	51.4 DM
Total Cr	23.9 MA	68.53 DM
Hex Cr	2.01 MA	4.48 DM

Accompanying Fact Sheet presents the following revisions:

- Increased vacuum distillation production from 114.6 BPSD to 159.0 BPSD
- Process Configuration Factor from 7.98 to 8.12
- Process Factor from 1.00 to 1.09
- Stormwater credit given for BOD5, TSS, COD, O&G, Phenols, Total Cr, Hex Cr
- Phenols 73.0 DM limit retained from expiring permit. Calculated ELG was 82.49 DM
- Ammonia limits retained from expiring permit. Calculated ELGs were 1,656.6 MA and 3,618.5 DM

Doc # 15 - 1989 Permit Renewal Application

Flow values given in application were:

	Outfall 001(mgd)	Outfall 002 (mgd)
Daily Maximum	24.7	127
Maximum Monthly Average	17.5	120
Long Term Average	15	111

See Doc #16 for production capacity = 324,900 BPSD

Doc #16 – March 5, 1990 Final NPDES Permit (expiration date = Feb 28, 1995)

	Final limits		Calculated ELGs	
BOD_5	4,161 MA	8,164 DM	4,429 MA	8,676 DM
TSS	3,646 MA	5,694 DM	3,879 MA	6,059 DM
COD	30,323 MA	58,427 DM	32,016 MA	59,732 DM
O&G	1,368 MA	2,600 DM	1,454 MA	2,766 DM
Phenols	20.33 MA	73.01 DM	22.72 MA	91.86 DM
Ammonia	1,030 MA	2,060 DM	1,748 MA	3,819 DM
Sulfide	23.1 MA	51.4 DM	24.4 MA	54.3 DM
Total Cr	23.9 MA	68.53 DM	26.72 MA	76.67 DM
Hex Cr	2.01 MA	4.48 DM	2.26 MA	5.04 DM

Accompanying Fact Sheet presents the following information:

- Subcategorized as a Lube Refinery (Subpart D – Lube Subcategory of 40 CFR Part 419, Petroleum Refining Point Source Category promulgated October 18, 1982 for BOD5, TSS, COD, O&G, Ammonia, Sulfide)
- Part 419 guidelines were subsequently altered by the Petroleum Refinery Settlement agreement of April 17, 1984, effective May 1, 1984 for Phenols, Total Cr and Hex Cr
- Petrochemical operations account for 5% of total production
- Maximum short term capacity = 410,000 BPSD of feedstock (crude oil) fed to topping units
- Limitations are based on actual production (high month from past 12 months given in Form 2C application = 324,900 BPSD) instead on designed capacity
- Process Configuration Factor = 8.897
- Size Factor = 1.19
- Process Factor = 1.19
- Ballast credit given for BOD5, TSS, COD, O&G
- Stormwater credit given for BOD5, TSS, COD, O&G, Phenols, Total Cr, Hex Cr

- All final limits = expiring permit since they were less than the calculated ELGs. "The effluent limitations for the above parameters have been retained from the previous permit in accordance with Section 402(o) of the Clean Water Act of 1987 which states, "a permit may not be renewed, reissued, or modified on the basis of effluent guidelines promulgated under Section 304(b) subsequent to the original issuance of such permit, to contain effluent limitations which are less stringent than the comparable effluent limitations in the previous permit." There are exceptions to this rule in Section 402 but Amoco does not qualify for any of the exceptions since Amoco is consistently meeting all of the current effluent limitations. Therefore, the effluent limitations from the previous permit shall be retained in the new permit even though the limitations calculated using the guidelines are less stringent."
- Outfall 001 effluent flow = 17 mgd average and 24.3 mgd max
- Outfall 002 effluent flow = 119.5 mgd average and 123.8 mgd max

Doc #17 – August 23, 1994 Permit Renewal Application Volume III

	Calculated ELGs	
BOD5	5,823 MA	10,393 DM
TSS	4,645 MA	7,258 DM
COD	38,320 MA	73,736 DM
O&G	1,742 MA	3,309 DM
Phenols	25.15 MA	77.2 DM
Ammonia	2,206 MA	4,819 DM
Sulfide	30.8 MA	68.5 DM
Total Cr	29.51 MA	84.79 DM
Hex Cr	2.43 MA	5.44 DM

- Subcategorized as a Lube Refinery (Subpart D – Lube Subcategory of 40 CFR Part 419, Petroleum Refining Point Source Category promulgated October 18, 1982 for all parameters)
- Part 419 guidelines were subsequently altered by the Petroleum Refinery Settlement agreement of April 17, 1984, effective May 1, 1984 for Phenols, Total Cr and Hex Cr
- Calculated ELGs = minimum of 1982 or 1984 Part 419 guidelines
- Limitations are based on actual production (high month for 1991 to 1994 = 410,000 BPSD)
- Process Configuration Factor = 8.521
- Size Factor = 1.19
- Process Factor = 1.19
- No ballast credit or stormwater credit given for any parameter
- Outfall 001 effluent flow:

- Daily maximum = 32.4 mgd
- Maximum monthly Average = 22.54 mgd
- Long term average = 12.61 mgd

- Outfall 002 effluent flow:
  - Daily maximum = 130 mgd
  - Maximum monthly Average = 117 mgd
  - Long term average = 103 mgd

Doc #18 – April 2, 2002 Permit Renewal Application Volume I

	Calculated ELGs	
BOD_5	5,447 MA	9,805 DM
TSS	4,358 MA	6,834 DM
COD	38,031 MA	73,289 DM
O&G	1,585 MA	2,971 DM
Phenols	19.45 MA	73.29 DM
Ammonia	2,971 MA	6,537 DM
Sulfide	28.72 MA	64.38 DM
Total Cr	22.85 MA	65.64 DM
Hex Cr	1.87 MA	4.20 DM

- Subcategorized as a Cracking Refinery (Subpart B – Cracking Subcategory of 40 CFR Part 419, Petroleum Refining Point Source Category promulgated October 18, 1982 for all parameters)
- Part 419 guidelines were subsequently altered by the Petroleum Refinery Settlement agreement of April 17, 1984, effective May 1, 1984 for Phenols, Total Cr and Hex Cr
- Calculated ELGs = minimum of 1982 or 1984 Part 419 guidelines
- Limitations are based on actual production (August 1997 = high month = 420,600 BPSD)
- Process Configuration Factor = 8.79
- Size Factor = 1.41
- Process Factor = 1.67
- No ballast credit or stormwater credit given for any parameter

- Outfall 001 effluent flow:
  - Daily maximum = 25.5 mgd
  - Maximum monthly Average = 19.9 mgd
  - Long term average = 17.6 mgd

- Outfall 002 effluent flow:
  - Daily maximum = 125.9 mgd
  - Maximum monthly Average = 119.6 mgd
  - Long term average = 106.3 mgd

Doc #19 – November 3, 2006 Permit Renewal Application Addendum for CXHO

	Calculated ELGs	
BOD_5	6,156 MA	11,081 DM
TSS	4,925 MA	7,723 DM
COD	42,980 MA	82,825 DM
O&G	1,791 MA	3,358 DM
Phenols	32.8 MA	82.8 DM
Ammonia	3,358 MA	7,387 DM
Sulfide	32.5 MA	72.8 DM
Total Cr	38.1 MA	109.1 DM
Hex Cr	3.13 MA	7.01 DM

- Subcategorized as a Cracking Refinery (Subpart B – Cracking Subcategory of 40 CFR Part 419, Petroleum Refining Point Source Category promulgated October 18, 1982 for all parameters)
- Part 419 guidelines were subsequently altered by the Petroleum Refinery Settlement agreement of April 17, 1984, effective May 1, 1984 for Phenols, Total Cr and Hex Cr
- Calculated ELGs = minimum of 1982 or 1984 Part 419 guidelines
- Limitations are based on Summer Track 1 configuration production (= 420,000 BPSD)
- Process Configuration Factor = 13.76
- Size Factor = 1.41
- Process Factor = 1.89
- No ballast credit or stormwater credit given for any parameter
- Outfall 001 effluent flow:
    - Pre-CXHO Maximum Monthly Average = 21.4 mgd
    - Post-CXHO Maximum Monthly Average = 21.4 mgd

- Outfall 002 effluent flow:
    - Pre-CXHO Maximum Monthly Average = 96.4 mgd
    - Post-CXHO Maximum Monthly Average = 81.8 mgd

HISTORY OF BP WHITING REFINERY OUTFALL 001 TECHNOLOGY BASED EFFLUENT LIMITS

	August 27, 1974 Draft NPDES Permit		November 18, 1974 Final NPDES Permit		December 22, 1975 Final NPDES Permit		May 13, 1980 Final NPDES Permit		March 29, 1985 Final NPDES Permit		May 13, 1985 Final NPDES Permit		March 5, 1990 Final NPDES Permit		August 23, 1994 Renewal Application		April 2, 2002 Renewal Application		November 3, 2006 Renewal Application	
40 CFR 419	?		?		?		?		Subpart D Lube		Subpart D Lube		Subpart D Lube		Subpart D Lube		Subpart B Cracking		Subpart B Cracking	
Crude Capacity (barrel/day	315,000 ?		360,000 ?		?		?		336,100		336,100		324,900		410,000		420,600		420,000	
Process Config Factor	?		?		?		?		7.98		8.12		8.897		8.521		8.790		13.76	
Size Factor	?		?		?		?		1.19		1.19		1.19		1.19		1.41		1.41	
Process Factor	?		?		?		?		1.00		1.19		1.19		1.19		1.67		1.89	
Ballast Credit?	No		No		Yes		Yes		Yes		Yes		Yes		No		No		No	
Stormwater Credit?	No		No		No		No		No		Yes		Yes		No		No		No	
All values in lb/day																				
BOD_5	2,800 MA	6,800 DM	3,200 MA	7,775 DM	3,372 MA	8,103 DM	5,220 MA	10,760 DM	3,724 MA	7,320 DM	4,161 MA	8,164 DM	4,429 MA (d)	8,676 DM (d)	5,823 MA	10,393 DM	5,447 MA	9,805 DM	6,156 MA	11,081 DM
TSS	3,121 MA	5,281 DM	3,570 MA	6,040 DM	4,530 MA	7,082 DM	4,590 MA	7,520 DM	3,268 MA	5,104 DM	3,646 MA	5,694 DM	3,879 MA (d)	6,059 DM (d)	4,645 MA	7,258 DM	4,358 MA	6,834 DM	4,925 MA	7,723 DM
COD	31,690 MA	60,670 DM	36,230 MA	69,360 DM	36,230 MA	69,360 DM	37,850 MA	76,340 DM	27,200 MA	52,360 DM	30,323 MA	58,427 DM	32,016 MA (d)	59,732 DM (d)	38,320 MA	73,736 DM	38,031 MA	73,289 DM	42,980 MA	82,825 DM
Oil and Grease	1,440 MA	2,737 DM	1,650 MA	3,130 DM	1,705 MA	3,233 DM	1,720 MA	3,430 DM	1,226.8 MA	2,330.4 DM	1,368 MA	2,600 DM	1,454 MA (d)	2,766 DM (d)	1,742 MA	3,309 DM	1,585 MA	2,971 DM	1,791 MA	3,358 DM
Phenolic Compounds	31 MA	64 DM	35 MA	73 DM	35 MA	73 DM	35 MA	73 DM	19.5 MA	80.46 DM (a)	20.33 MA	82.49 DM (a)	22.72 MA (d)	91.86 DM (d)	25.15 MA	77.2 DM	19.45 MA	73.29 DM	32.8 MA	82.8 DM
Ammonia as N	900 MA	1,200 DM	1,030 MA	1,370 DM	1,030 MA	2,060 DM	1,030 MA	2,060 DM	1,520 MA (b)	3,320 DM (c)	1,657 MA (b)	3,619 DM (c)	1,748 MA (d)	3,819 DM (d)	2,206 MA	4,819 DM	2,971 MA	6,537 DM	3,358 MA	7,387 DM
Sulfide	25 MA	57 DM	29 MA	65 DM	29 MA	65 DM	30 MA	71 DM	21.2 MA	47.2 DM	23.1 MA	51.4 DM	24.4 MA (d)	54.3 DM (d)	30.8 MA	68.5 DM	28.72 MA	64.38 DM	32.5 MA	72.8 DM
Total Chromium	77 MA	131 DM	88 MA	150 DM	88 MA	150 DM	92 MA	164 DM	22.8 MA	65.6 DM	23.9 MA	68.53 DM	26.72 MA (d)	76.67 DM (d)	29.51 MA	84.79 DM	22.85 MA	65.64 DM	38.1 MA	109.1 DM
Hexavalent Chromium	1.3 MA	2.8 DM	1.5 MA	3.2 DM	6.0 MA	13.0 DM	6 MA	14.4 DM	1.9 MA	4.2 DM	2.01 MA	4.48 DM	2.26 MA (d)	5.04 DM (d)	2.43 MA	5.44 DM	1.87 MA	4.20 DM	3.13 MA	7.01 DM

MA = monthly average, DM = daily maximum
(a) = previous permit limit retained = 73.0 lb/day
(b) = previous permit limit retained = 1,030 lb/day
(c) = previous permit limit retained = 2,060 lb/day
(d) = ELG calculated in Fact Sheet; previous permit limits applied